volumes, of liquid samples onto a substrate, such as a microarray substrate, at high throughput rates by dipping a slotted pin tool (a pin tool having one or more pins with slotted ends) having an open tip into a sample reservoir or well containing a liquid sample to be delivered onto the substrate, thereby drawing a volume of liquid sample up into the pin tool. The slotted pin tool is then moved toward the substrate at a predetermined rate and then is halted, thereby expelling the liquid sample from the slotted pin tool onto the reaction location of the substrate. Thus, the sample fluid is expelled from the slotted pin tool by the force of momentum. The volume of liquid sample expelled is proportional to the momentum of the moving pin tool (*i.e.*, the amount delivered is proportional to the velocity of the pin tool as it contacts the surface or to the velocity of the liquid in a pin when movement of the pin tool is halted). Hence volume delivered is a function of the speed of moving the pin tool toward the microarray, which provides a way to accurately control and deliver desired sample volumes. For each pin tool size there is a range of volumes in which the amount of volume delivered is linearly related to the velocity of the pin tool. Sample volume delivered is not dependent on tip surface area, thereby providing for flexibility in use since it is not necessary to change pins to dispense different volumes.

Please replace the paragraphs on page 6, lines 8-26, with the following paragraphs:

By virtue of the pin tool design herein, it is possible to transfer the sample to a pre-determined locus on a substrate that already has pre-deposited material, such as matrix, cells, such as bacterial or mammalian cells, protein crystals and other materials sensitive to contact. Since the instant tools provided herein rely on inertial forces for delivery, delivery of liquids is primarily dependent upon the momentum of the liquid in the slotted tool, not on the relative surface tensions of the pin and the substrate for the liquid. As one result, the pin tools provided herein permit accurate and controlled delivery of defined volumes by selection of

the velocity of the tool at impact or as it reaches the substrate and is stopped prior to contact.

Substrates that contain two materials, a photoresist material treated to render it resistant to chemical treatments such as silation used in mass spectrometry and other synthetic procedures, and a second more hydrophobic material are provided. Unlike most substrates that employ photolithographic methods, the photoresist is not removed from the surface, but includes the target loci of the surface. This is achieved by baking the substrate. Hence a substrate that contains photoresist material as the target loci are provided.

Please replace the paragraph on page 13, lines 11-15, with the following paragraph:

As used herein, a combination refers to any association between or among two or more items. The combination can be two or more separate items, such as two compositions or two collections, can be a mixture thereof, such as a single mixture of the two or more items, or any variation thereof.

Please replace the paragraph beginning on page 17, line 20, through page 18, line 7, with the following paragraph:

Delivery System

As noted the delivery system provided herein delivers small volumes, typically submicroliter volumes, of liquid samples onto a substrate at high throughput rates by dipping a slotted pin tool having an open tip into a sample reservoir or well containing a liquid sample to be delivered onto a substrate, thereby drawing a volume of liquid sample up into the pins in the pin tool. The pin tool with slotted pin(s)is moved from the sample well to an elevated position above a reaction location on the microarray that is to receive the liquid sample, is lowered toward the substrate at a predetermined speed, and then the movement of the pin tool toward the substrate is halted, thereby expelling the liquid sample from the slotted pin tool onto the reaction location of the

substrate, such that the sample fluid is expelled from the slotted pin tool by the force of momentum. The volume of liquid sample expelled is determined by the speed of moving the pin tool toward the microarray. Typically the pin tool contains a plurality of slotted pins. In certain embodiments, the outer surface of the pin is rendered hydrophobic, such as by silation or other chemical means, relative to the inner surface to thereby reduce or eliminate any satellite drops that adhere to the outer surface.

Please replace the paragraph beginning on page 22, line 27, through page 23, line 12, with the following paragraph:

The proper alignment of the pin tools over target locations of the appropriate chip is a critical process, and can be accomplished for example, by the system 100 with a robotic vision unit 140. Initial alignment for a particular pin tool can be accomplished in a number of ways. For example, a camera is mounted on the machine that seeks the target. To align the pin tool with the target loci, it is necessary to locate pin(s) relative to the target and/or the pins. To locate the pins, the pins are, for example, dipped into a dye or ink and then contacted with a blank substrate. The camera and software therefor then "learns" or images the locations of the spots and can then direct the pin tool to the corresponding positions on the actual substrate. Alternatively, other marks can be used. Transparent sticky tape can be placed on the surface of the blank substrate and the pin touched thereon to imprint its image on the tape. The camera with software can then learn the locations of the pins. This procedure can also be automated. Such procedure should be performed for each pin tool to create an image thereof so that the loci on the substrate and the pins can be properly aligned.

Please replace the paragraphs beginning on page 33, line 1, through page 34, line 8, with the following paragraphs:

Also provided are methods of producing substrates and the resulting substrates that have contact angles that result in hydrophobic focusing of hydrophilic liquids on loci formed from photoresist materials. The resulting substrates include elements (loci) on a surface that are less hydrophobic than the surrounding surface, where hydrophobicity is measured by the relative wettability (relative contact angle) of the surrounding area compared to each locus (element). The contact angle of each element is less than that of the surrounding surface. To produce such arrays, a surface, such as any of those described herein or known to those of skill in the art to be suitable for linking or retaining macromolecules, including biopolymers, such as silicon or SiO_2 is coated with photoresist, covered with a mask that blocks light as loci on the surface, and exposed to light, the photoresist in the unmasked portions is washed off. The resulting surface is baked to render the photoresist stable to chemical treatments such as silation. The surface is then silated. Since the silane does not stick to photoresist, the resulting surface has silated regions that surround the photoresist elements at the loci. Examples 1 and 3 exemplify this process and the resulting substrates with patterned microarrays. The substrates are preferably about 3000 mm x 2000 mm, such as 3068 mm x 1960 mm, or can be smaller or larger. The number of elements (loci) on each substrate can be any desired number, such as, 8, 16, 24, 96, 384, 1536, higher densities or any convenient number. Other combinations of surface materials in which the contact angle between the two surfaces is less than or equal to 20 °C are contemplated.

The step of baking the photoresist on the target loci renders the surface resistant to chemical treatments, such as silation. The selection of the temperature and time is selected so that the photoresist does not become too hydrophobic relative to the rest of the surface for the liquid to be focussed at the target loci. Baking should be performed at temperatures of about